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2 April 1964

RESEARCH OBJECTIVES

ORBITAL-TERRESTRIAL PHOTOGRAPHIC EVALUATION STUDY

1. INTRODUCTION.

A study is proposed to evaluate the present operational capability of the KH-4 system by relating its photography to specific ground data gathered at ground stations at time of exposure. The program would be based on a number of high-altitude missions with the CIII camera used with the 112-A configuration (same camera-type as in the orbital system). These missions would be planned and flown in conjunction with programmed orbital missions.

Problems in resolution, acuity and ground truth cannot be fully solved through laboratory testing. During the process of the various systems development, it has been standard procedure to test cameras under controlled laboratory conditions. This provided statistics on a camera's characteristics in known environments; however, extensive correlation of operational factors -- actual environmental and ground parameters -- has not been made. In the proposed program, by photo- 25X1A graphing ground targets in [redacted] areas with both KH-4 and 112-A systems, data will be collected and correlated on the effect of ambient, high-altitude and orbital environmental conditions on the systems.

2. CONCEPT. 25X1B

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2.2. Scope. This program will be divided into two phases, operational and support.

2.2.1. Operational phase:

25X1A 2.2.1.1. Orbital photography over [redacted] areas with the KH-4 camera system.

2.2.1.2. Aircraft flights using the 112-A configuration to obtain photography of the same areas (which would be through 30% of the earth's atmosphere).

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2.2.1.3. Ambient data determined by instrumentation at ground stations in the flight path, photographed by the orbital and aircraft flights.

2.2.2. Support procedures:

25X1A 2.2.2.1. Evaluation by a group of photo interpreters of all [redacted] photography which includes the ground stations.

2.2.2.2. Correlation of ground station data with evaluations of photographic quality.

2.2.2.3. Analyses of the program to establish criteria for assessing these and similar missions.

2.2.3. It is anticipated that sufficient information cannot be obtained from one concurrent attempt; therefore, a program should be carried on until sufficient trends are established and accurate prediction of the results of subsequent missions are made and proven valid.

2.2.4. Test procedures outlined in this report need not be restricted to these two systems but could be the basis for operational testing of a wide variety of camera systems. This program would provide criteria by which photographic quality for varying operational conditions could be predicted with great accuracy.

3. REQUIREMENTS.

25X1A 3.1. Orbital Photography. The programmed exposure of film over [redacted] test areas shall be made in the normal course of the KH-4 mission. It would be necessary to know the time and exact geographic location of the vehicle to enable the planning of underflights for the same time, over the same area.

3.1.1. For comparison with the film from most of the previous KH-4 missions, Eastman Kodak film 4404 (SO 132) should be used in all cameras.

3.1.2. Camera calibrations and other statistics (such as slit width, ramp setting, etc.) shall be recorded as part of the related data.

3.1.3. Orbital parameters such as temperature, geographic location, altitude and attitude should be provided.

3.1.4. The "camera calibration log" and other ephemeral data should be correlated with any additional information that the Eastman Kodak Company can supply on 4404 film-processing and film-handling.

3.2. High-Altitude Photography. For the purpose of correlating systems capability, a high-altitude aircraft with a 112-A camera configuration is required.

3.2.1. Eastman Kodak film 4404 (SO 132) shall also be used.

ILLEGIB 3.2.2. Camera calibration and other statistics (such as slit width and scan rate) shall be included in the report.

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3.2.3. A flight log shall be kept on temperature, weather conditions, ground velocity, attitude, course and "Z" time. All deviations should be properly recorded.

3.2.4. Altitude of the photography will be 65,000 feet MSL and will be recorded at the start and termination of photographic pass.

3.2.5. The direction of flight and flight path will approximate that of the orbital vehicle.

3.2.6. Collateral information -- in the form of flight logs, camera data logs and processing data reports -- should be made available.

3.3. Ground Stations. These would include suitable areas along the flight path of the orbital vehicle which are accessible for set-up of appropriate instrumentation and from which objects of interest can be surveyed.

3.3.1. Ambient data will be collected one hour prior to, during, and one hour after the scheduled operational photographic missions. These data will include, but will not necessarily be limited to, the following:

a. Spectral Reflectance.
b. Sun Angle:
   (1) "Z" time.
   (2) Date.
   (3) Geographic Location.
c. Gray scale equivalent of targets.
d. Light intensity.
e. Altitude.
f. Barometric pressure.
g. Temperature.
h. Humidity.
i. Atmospheric conditions (haze, smoke, % of cloud cover, cloud-type and wind velocity).
j. Dimensions (object sizes and shapes).

3.3.2. Densely populated areas offer a great variety of image sizes and shapes, and securing actual object dimensions should be relatively easy.

25X1A [redacted] (Military installations, for instance, would simplify measurement tasks.) Measurements of roads, sidewalks, vehicles or other appropriate objects can be made at any convenient time and incorporated into the report.

3.3.3. Sparsely populated and open areas can be used to determine low-contrast functions of the camera systems and can also be used for images of isolated features such as houses, vehicles, railroad lines, fence intersections, streams and the like.

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3.3.4. Areas to be designated for these surveys will be determined at the earliest possible time so that correlation of control conditions can be made with orbital photography. Ground photography of buildings, roads, etc., will be used to supplement target identification wherever possible.

3.3.5. This phase could be carried out through contracts with "cleared" commercial companies. On the other hand, due to the proposed variety and extent of ground test areas (such as densely-populated, sparsely-populated and open land), it may be more desirable to solicit Air Force or other service support. The number of instruments and personnel necessary and the general extent of the project are factors that may limit the number of interested commercial companies.

3.3.6. All field data, accumulated as part of this project, will become Government property and shall not be reproduced without consent of the project monitor.

3.4. Photo Interpretation. An evaluation of orbital and high-altitude photography will be made by cleared Air Force, Army and NPIC personnel.

3.4.1. On all photography to be evaluated by the Photo Interpretation Teams, ground target areas must be specifically identified.

3.4.2. Measurements of film images will be compared with the physical dimensions of the same objects on the ground. Two measurements should be made: one by the photo interpretation teams with available equipment; and the other by more accurate mensuration procedures using a [redacted] Comparator or a similar instrument. Both measurements must be scaled and compared to the actual object dimensions.

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